DOE Office of Petroleum Reserves

Fact Sheet: Oil Shale and the Environment

Surface Impacts

- America's best oil shale resources are highly concentrated in several major deposits in Colorado, Wyoming and Utah. The areas are semi-arid and sparsely populated.
- Current uses include recreation, sheep and cattle grazing, mining, and oil and gas production.
- The area has considerable wildlife, including large mammals and migratory birds.
- Portions of the oil shale lands are in or adjacent to conservation and wilderness areas and scenic vistas.

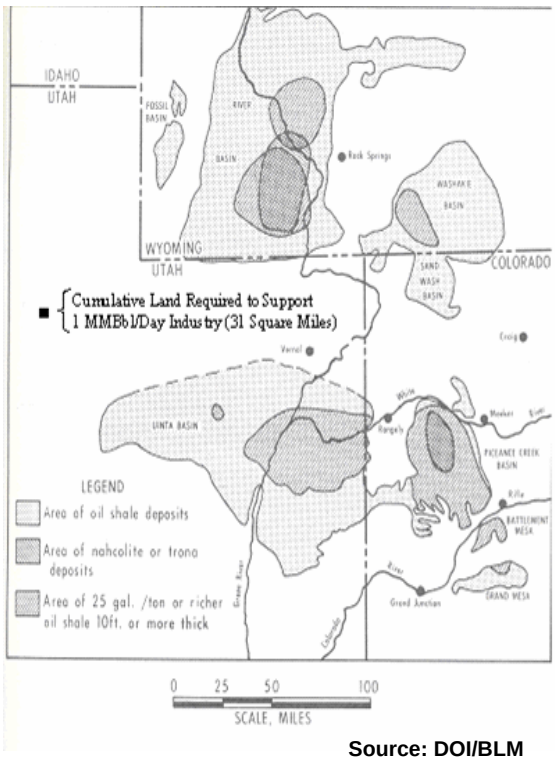
How Much Land Will Be Required for Oil Shale Development?

- The richest oil shale deposits in the world are located in Colorado's Piceance Creek Basin and in the Uinta Basin, in Utah.
- Depending on depth, thickness, richness, and accessibility, oil shale may be surface mined, underground mined, or heated in-situ (i.e., in the ground). Deeper and thicker beds will likely be produced in-situ. A combination of these three approaches will likely be used.
- In 1972, the Department of the Interior estimated the cumulative surface area impacted by a domestic oil shale industry – over a 40 year period – would be ~31 square miles per million barrels of daily shale oil production capacity (MM Bbl/d). (Figure 1)[1] This figure could increase if surface processes comprise a greater share of operations than assumed in the 1972 Prototype Leasing Program, or decrease if new in-situ processes comprise a greater share.

What Land Impacts are Associated with Oil Shale?

- **Open-Pit (surface) mining** involves significant surface disturbance and can impact surface-water runoff patterns, subsurface water quality, flora, and fauna. Experience in coal mining and other mining industries has demonstrated that impacted lands can be very effectively reclaimed with minimal long-term effect.
- **Underground mining** involves much less surface disturbance. Surface impacts can be limited but will include run-off and fugitive dust emissions from shale transport and storage.

Figure 1- Surface Area Required to Support Oil Shale Production



Source: DOI/BLM

- **In-situ production** may involve limited mining to access the resource or drilling heater holes and production wells at very close spacing. Impacts will be similar to those experienced in oil and gas drilling operations. Heater holes and wells will likely require plugging and abandonment when heating and production operations cease.
- **Other surface impacts** will occur in association with construction of surface facilities, including retorting, upgrading, storage, and transportation. New pipelines, roads, and utilities, will also have surface impacts
- **Spent shale**: Surface retorts generate quantities of spent shale. Retort technology has improved to reduce residual carbon, making spent shale better suited for landfill. Backfilling will be employed in underground and surface mines. Some spent shale will be used to make commercial building materials, or landfilled. Satisfactory disposal and reclamation has been achieved in later-generation oil shale operations.

Air Quality Impacts

- Most western oil shale ore is a carbonate-based, kerogen-bearing marlstone. Heating carbonate rock to 450 to 500 degrees centigrade generates not only kerogen oil and hydrocarbon gases but also a slate of other gases, including: (1) oxides of sulfur and nitrogen, (2) carbon dioxide, (3) particulate matter, and (4) water vapor. Fugitive dust and fine particulates may also pose concern.
- Commercially available stack gas clean-up technologies, currently in use in electric power generation and petroleum refining facilities, have improved over the years and should be effective in controlling oxides and particulates emissions.
- Carbon dioxide (CO_2) will be produced in large quantities and may need to be captured, used in other commercial applications (such as improved oil recovery or coalbed methane operations), or otherwise sequestered. Depleted oil and gas reservoirs in the local area may provide effective sequestration targets.

Water Quality Impacts

- Runoff from mining and retorting operations can impact surface and groundwater. In-situ operations pose greater risks to groundwater quality. Controls will be required to protect surface and groundwater.
- Effective technologies and management processes already exist and have been demonstrated in other commercial-scale mining and chemical processing applications.
- In-situ processes have been particularly challenged to protect groundwater from contamination by kerogen oil or other produced gases and sediments.
- Promising freeze-wall technologies are being tested to isolate ground water from subsurface in-situ processing areas until post-production flushing and clean-up of the heated areas has been completed.

What Major Federal Laws and Regulations Will Apply to Oil Shale Development?

- National Environmental Policy Act (NEPA)
- Clean Air Act (CAA)
- Resource Conservation and Recovery Act
- Clean Water Act
- Comprehensive Environmental response, Compensation, and Liability Act (CERCLA)
- Emergency Planning and Community Right-to-Know Act
- Pollution Prevention Act
- Toxic Substances Control Act
- Endangered Species Act

State and local environmental standards and permitting processes must also be adhered to. In some cases, as with the Clean Air Act, the Federal regulation sets the minimum allowable standard and entrusts its implementation to the states under State Implementation Plans. The states have the latitude to apply a stricter standard than the Federal standard if they so choose.

Changes since the 1970s

- Maturation of environmental laws and regulations has resulted in more stringent standards and requirements.
- Commercial operations and environmental control technologies have advanced to improve efficiency, and reduce or better control effluents and emissions.
- Companies have implemented sophisticated environmental and safety management systems that are incorporated into project development and plant management and operations.

What is the Current Permitting Environment for Commercial Mining and Processing?

- Oil shale projects will require permits and approvals from several levels of government
- As environmental laws have matured, some permitting processes have improved, but permitting delays remain a major risk for large mining and industrial projects.
- The Energy Policy Act of 2005 establishes a prototype program for streamlining permitting processes for energy projects, in a selected group of states, including Colorado, Utah, and Wyoming.

References

[1] "Final Environmental Impact Statement for the Prototype Leasing Program", U.S. Department of the Interior, Bureau of Land Management, Volume 1, 1973.